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New Solution of Kepler's Problem. By Professor P. A. Hansen.

(*Extract from a Letter to the Astronomer Royal.*)

"It is well known how much labour has been bestowed by geometers on the solution of Kepler's problem; and what complicated results have been obtained for the coefficients in the expression for the equation of the centre. I have lately found a new solution of this problem, which differs strikingly from former solutions in this respect, that it leads to an unexpectedly simple law of coefficients. It is as follows:—

Let g be the mean anomaly.
φ the angle of eccentricity.
i any positive integer number.

$$\text{Put } \beta = \tan\frac{\varphi}{2}, \qquad \mu = i \cos^2\frac{\varphi}{2}$$

$$P_i = 1 + \mu + \frac{\mu^2}{2} + \frac{\mu^2}{2.3} + \&c. + \frac{\mu^i}{2.3 \ldots i} \qquad Q_1 = 1 - \mu$$

$$P_{i+1} = P_i + \frac{\mu^i + 1}{2.3 \ldots i + 1} \qquad Q_2 = Q_1 + \frac{\mu^2}{2}$$

$$\&c. \qquad Q_3 = Q_2 - \frac{\mu^3}{2.3}$$

$$\&c.$$

Then the equation of the centre =

$$(1-\beta^2)\,\Sigma_1^\infty \frac{2}{i}\Big\{P_i\,.\,\beta^i + P_{i+1}\,.\,Q_1\,.\,\beta^{i+2} + P_{i+2}\,.\,Q_2\,.\,\beta^{i+4}\,.$$

$$+ \&c.\Big\} \sin i g.$$

"The analysis which has led me to this, and the form of this result, are by no means peculiar to the equation of the centre only, but apply to all functions which it is necessary to develope in series proceeding by sin $i\,g$, or cos $i\,g$."

On the Brilliancy of the variable Star α Orionis. By Mr. Isaac Fletcher, Tarn Bank.

"In a communication read before the Royal Astronomical Society on January 10, 1840, Sir John Herschel points out and establishes by indubitable evidence the variability and periodic nature of the star *α Orionis*. In that paper, Sir John states as the result of his numerous observations and comparisons, that the brilliancy of this star, when at its maximum, is superior to that of

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Rigel, but most decidedly inferior to that of *Capella*, which of late years has undoubtedly been the brightest star in the northern hemisphere.

"On the evening of the 5th December, 1852, I was much struck with the extraordinary brightness of *α Orionis;* and notwithstanding its inferiority of altitude, on carefully comparing it with *Capella*, I had no hesitation in concluding *α Orionis* to be the brighter star. Nor was this to be attributed to any diminution of lustre in *Capella;* for in the earlier part of the evening, when *α Lyræ* and *Capella* were of nearly equal altitude, I compared them together, and *Capella* was unquestionably the more brilliant.

"As regards *α Orionis* and *Capella*, on the night in question, I appealed to the judgment of two friends, both of whom deliberately and repeatedly compared the stars together, and assigned the superiority to *α Orionis.* On the 6th December I made another comparison; and although I thought the difference in brightness was less obvious than on the previous evening, still I did not hesitate to assign the superiority to *α Orionis;* such was also the judgment of another person to whom I referred the matter.

"Next evening I again compared the stars, and although the neighbourhood of *Orion* was occasionally obscured by fog, I concluded *α Orionis* to be fully equal, if not superior, to *Capella.* The following evening the sky was too hazy for accurate comparison.

"I, however, consider this fact to be clearly established; viz. that on or about the 5th of December, 1852, *α Orionis* was at or near its maximum brilliancy, and that at that time *it was the brightest star in the northern hemisphere.*

"I hope the circumstance I have above recorded will induce those observers who are watching the phenomena of the variable stars, to pay particular attention to this object.

"*December 9th,* 1852."

Mr. W. Rothwell exhibited a small transit instrument on a peculiar construction.

The telescope, which is only 14 inches long, is fixed on a brass pillar, so as to look downwards at about an angle of 45°; it thus somewhat resembles in appearance a solar microscope as usually mounted. The brass pillar is attached to a horizontal plate, which has the necessary adjustments for setting it level, and also for giving it a small motion in azimuth. In the line of sight of the telescope, and pretty close to the object-glass, there is a horizontal axis at right angles to the telescope. This axis rests on Ys as an ordinary transit; it has the same adjustments and riding level. In the centre of the axis is placed a mirror, like the index-glass of a sextant, into which the telescope looks for all its objects. The instrument being placed approximately in the meridian, and the

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horizontal plate and the axis being carefully levelled, the axis is turned round until the wires of the telescope, which are illuminated by a side-lamp, are seen by reflexion from the mirror. The wires seen thus reflected are made to coincide with the wires seen *directly*, by the screws at the eye-end, in the usual manner. The axis is then reversed, and the reflected and direct wires again made to coincide,—half by moving the collimation adjusting-screws, and half by the two screws at the back of the mirror. When the axis is returned to its original position, if the direct and reflected wires coincide, the reflecting surface will be perpendicular to the optical axis and parallel with the horizontal axis.

At one end of the horizontal axis there is an altitude-circle, which is fitted exactly as in the usual portable transit; the vernier shows the angle through which the mirror is turned. The mirror must be turned round till a known star is found and bisected by the horizontal wire, when a comparison of the vernier reading with the known polar distance of the star will enable the observer to set the vernier to the exact reading, north polar distance, or altitude, or zenith distance, which he requires.

The whole instrument must be set in the meridian by making the stars near the south horizon give the same clock-error as the stars near the zenith. Mr. Rothwell recommends this form of transit, not account of its superior accuracy, but superior convenience, and considers it as sufficient for ordinary purposes. The stand would probably be less liable to change if the mounting were *cut out of stone*. With nice workmanship, an excellent mirror, and great care, considerable accuracy might no doubt be attained. A meridian-mark would be a desirable check for rating time-keepers, if any well-defined object could be found or placed in the meridian.

Mr. Norman Pogson, who is now attached to the Radcliffe Observatory, writes, that after his regular work for the evening is over (transit-observing), he employs the equatoreal, on fine nights, in searching for new planets, using Mr. Bishop's and the Berlin charts.

Mr. Pogson uses two diaphragms. No. 1 has a vertical bar, which passes through the field in the direction of a meridian, straight on one side, and toothed on the other. The transits are observed at the straight edge, and the differences of polar distances noted approximately at the toothed side: the teeth are about 2′ apart. No. 2 is adapted for observing faint objects. This consists of two bars arranged as a V; one of these is set in the meridian, and on this the transits are taken; the time between the two bars gives, by a slight computation, the distance of each star from the angular point. The angle may be varied to suit specific objects, as was done by Lacaille, but for ordinary purposes 45° is a convenient opening.

The telescope is also furnished with a good ring micrometer,

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with which Mr. Pogson made the observations of the small planets *Fortuna* and *Melpomene*, *Monthly Notices*, vol. xii. pp. 214, 217. The reductions are rather tedious, but when the difference of declination is less than 4′ or more than 6′, Mr. Pogson considers the results may be relied on. The different measures of the diameter of the ring agree very well.

Capt. Shea has presented some suggestions *on the cause of the large quantity of rain* which has recently fallen. His reasoning does not assign the phenomenon to celestial agency, but refers to the condition of the north polar region of the earth; the notice belongs, therefore, to meteorology rather than to astronomy.

In vol. 36 of the *Astronomische Nachrichten*, No. 844, p. 67, M. Luther, of the Bilk Obsorvatory, has given an approximate ephemeris of *Parthenope* for the present opposition. The ephemeris is for Berlin mean midnight, and extends from Jan. 16 to Feb. 25, 1853.

Astronomical Observations made at the Radcliffe Observatory, Oxford, in the year 1850. By Manuel J. Johnson, M.A., Radcliffe Observer. Vol. XXI. royal 8vo. (pp. 300, Introduction pp. xliv). Oxford, 1852.

The explanations necessary for a due appreciation of this work are given in the Introduction. The observations were made chiefly in the meridian, but there are a few determinations with the heliometer.

A detailed description of the meridian instruments has been given in former volumes. The great mass of the objects observed are circumpolar stars. Subordinate to these are the observed places of a limited number of fundamental stars, for the determination of instrumental and clock errors. There are also a few observations of the sun, as well as of the moon and moon-culminating stars.

The results of the circumpolar observations are presented in a catalogue adapted to the mean equinox of 1850·0. The number of stars is 2009. This contribution will serve nearly to complete the important catalogue of circumpolar stars which for several years has occupied so much of Mr. Johnson's attention. The re-observation of Groombridge's Catalogue may be now considered to be finished, and Mr. Johnson has appended to this volume an "Index of Stars in Groombridge's Catalogue, observations of which will be found in the eleventh and preceding volumes of the Radcliffe Observations." Until the Radcliffe Catalogue shall be published in a collected shape, which may soon be expected, this index will enable any one to determine the place of a star with very little trouble.

The circumpolar catalogue is followed by a smaller catalogue